

**The University of Western Ontario – Department of Statistical and Actuarial Sciences**  
**ACTUARIAL SCIENCE 2053**

*Mathematics for Financial Analysis -- 2021-22*

Instructor	Sec	Day/Time	Location	email	Office/Phone
Mr. Steve Kopp	001	MWF – 11:30- 12:20	SEB 1059	kopp@stats.uwo.ca	WSC 284/x86288
Mr. Joe Raaymakers	002	Tu – 9:30-11:20 Th – 10:30-11:20	SEB 1059	jraaymak@uwo.ca	WSC 107
Ms. M. Millard	570	Tues/Thur 11:30-1:00pm	LH101	mmillard@stats.uwo.ca	
Mr. Xing Jiang (King’s College)	571	Wed/Friday 11:30-1:00 pm	LH 103	xjiang32@uwo.ca LH 205	519-433-3491 x4530
Ms. M. Millard	572	Mon/Wednesday 2:30-4:00pm	LH103	mmillard@stats.uwo.ca	

**1. Pre-requisites**

Grade 12U calculus (or equivalent), PLUS one full university level course (or 2 half courses) from Mathematics, Applied Mathematics, Calculus, or Linear Algebra

**Anti-requisites:**

Actuarial Science 2553A

**Students are advised that they are responsible to ensure that they possess the necessary prerequisites (or have written special permission) and that de-registration may occur at any time if they lack the prerequisite or have taken an anti-requisite course.**

**2. Textbooks (both are available in the UWO bookstore)**

- NEW: “Mathematics of Finance”, 9th Edition, by Brown-Kopp (\$89)
- Study note package (which contains chapters 8 to 12) (around \$20 to \$25)

**3. Course Outline (course is divided into 2 terms):**

Text	Chapter	Topic
1. Textbook	1	Simple Interest and Simple Discount
	2	Compound Interest (skip section 2.10)
	3	Simple Annuities
	4	General and Other Annuities
	5	Repayment of Debts
	6	Bonds (skip Serial Bonds of section 6.7)
2. Textbook	7	Business Decisions, Capital Budgeting, Depreciation
3. Study Note Package	8	Fixed Income Investments
	9	Probability and Life Tables
	10	Life Annuities
	11	Life Insurance
	12	Life Insurance Expenses

**4. Term Tests**

1. Test 1: **Friday, October 22, 2021 -- 6 to 8 pm** – topics to be posted on OWL
2. Test 2: **Friday, March 4, 2022 -- 6 to 8 pm** – topics to be posted on OWL

The format will most likely be multiple-choice questions. A formula page will be provided for both tests. Both tests will be CLOSED BOOK.

**NOTE: There is NO makeup test to either Test 1 or Test 2. If you miss either test (with a valid reason), the 18% weight will be moved to the mid term exam (if you miss Test 1) or the final exam (if you miss Test 2). You should think twice before deciding to miss a test.**

## 5. Mid Term Exam

**To be scheduled during the December Exam period**

Chapters 1, 2, 3, 4, 5, and part of chapter 6

- The midterm exam will cover all material from the first term, including material that was tested on Test 1. It will be a 3-hour closed book exam that may either be multiple choice questions OR a combination of multiple choice and short written answer questions. A formula page will be provided.

## 6. Final Exam

**Scheduled for the final exam period.**

Rest of Chapter 6, all of chapters 7, 8, 9, 10, 11, 12

- The final exam will be a 3-hour closed book exam that may either be multiple choice questions OR a combination of multiple choice and short written answer questions. A formula page will be provided. It will be based on material covered in class only since the midterm exam but will include material from the 2<sup>nd</sup> term test.

**You will also need a pocket calculator (non-programmable) for the tests and the exams.**

## 7. In-class Quizzes

There will be 8 (4 per term) short written answer question quizzes that will be given at the very start of class on the following **Wednesdays (section 001) OR Tuesdays (section 002)**:

1	September 22, 2021 (001) September 21, 2021 (002)	5	January 19, 2022 (001) January 18, 2022 (002)
2	October 13, 2021 (001) October 12, 2021 (002)	6	February 9, 2022 (001) February 8, 2022 (002)
3	November 10, 2021 (001) November 9, 2021 (002)	7	March 16, 2022 (001) March 15, 2022 (002)
4	December 1, 2021 (001) November 30, 2021 (002)	8	March 30, 2022 (001) March 29, 2022 (002)

- The quizzes will start right at the start of the class on the above dates and you will have 15 minutes to complete the assigned question(s) – **do NOT be late for class on these dates as you will NOT be given extra time (PLUS: if you arrive more than 5 minutes after the quiz has started, you will NOT be allowed to write the quiz)**
- The quizzes will consist of 2 questions (or perhaps 1 question with multiple parts) that will be based on material covered over the past 2-3 weeks of classes
- The quizzes will be out of 8 marks – you will get 2 out of 8 just for signing your name and handing in a blank answer
- **If you miss a quiz due to an SRA (self-report), health reason, or due to a COVID-19 quarantine, that quiz will not count and your quiz grade will be based on the quizzes that you actually wrote/completed**

## 8. Evaluation

	<b>Original</b>	<b>If you do poorly on one test</b>	
Quizzes (8 of them)	10%	10%	10%
Test 1	18%	9%	18%
Mid Term	27%	36%	27%
Test 2	18%	18%	9%
Final Exam	27%	27%	36%

The marking scheme that gives a student the higher final mark will be the one used for that student.

## **9. Course OWL Web Page**

The web page will contain:

1. A copy of this course outline
2. Copies of tests and exams from the previous year (with solutions)
3. Solutions to the exercises in the 9<sup>th</sup> edition of the textbook (as pdf files)
4. Weekly updates and information about the course that you need to know
5. **Daily class notes (which will be incomplete – to be filled in during the classes)** and other things that are relevant to the course.
6. Marks of quizzes and tests as they are marked.

## **10. Course Objectives**

This course is not intended to make you financial geniuses or to suggest what investments or insurance products you should be buying.

Instead, the objective of this course is to show you how you can do many useful financial calculations yourself, either using a calculator, pen and paper OR using a computer spreadsheet. Some of the calculations you will be able to do by the end of the course include:

1. Accumulating & discounting a single sum of money using either simple or compound interest
2. Accumulating & discounting a series of payments made at equal time intervals using compound interest
3. Calculating loan payments, including mortgage payments
4. Depreciating physical assets
5. Determining the rate of return on an investment
6. Determining the price of a bond or the rate of return on a bond
7. Understanding the yield curve and the risks involved with a fixed income investment

In the last part of the course you will be introduced to the fundamentals of financial calculations involving life contingencies. You will be able to:

1. Perform calculations involving probabilities of living or dying within a certain period of time
2. Calculate how much money you need at a certain age to purchase an annuity paying you a certain amount of money every year or every month for the rest of your life
3. Calculate the premium to be paid for a certain type of life insurance policy

Your ability to do all the above (and more) will be evaluated through written answer questions on the in-class quizzes and through a combination multiple choice/written answer questions on two tests and two exams.

### 11. APPROXIMATE Weekly Course Outline:

<b>Week – 2021</b>	<b>Section</b>	
Sept 8-10	Accumulating/discounting simple interest (sect 1.1-1.2)	
Sept 13-17	Equations of value, partial payments, simple discount (section 1.3 to 1.5)	
Sept 20-24	Accumulating/discounting with compound interest, equivalent rates, fractional periods (section 2.1-2.4)	
<b>In-class Quiz #1 – Tues/Wed, September 21/22 at start of class</b>		
Sept 27-Oct 1	Determining the time and interest rate, equations of value, changing rates, other applications (section 2.5 to 2.9)	
Oct 4-8	Ordinary annuities – accumulated value (section 3.1, 3.2)	
Oct 12-15	Ordinary annuities – present value + other annuities (section 3.3, 3.4)	
<b>In-class Quiz #2 – Tues/Wed, October 12/13 at start of class</b>		
Oct 18-22	Other annuities (section 3.4); Determining term/rate (sections 3.5, 3.6)	
<b>Test 1 – Friday, October 22 – 6:00 to 8:00 pm (2 hours) – Chapters/Sections TBA</b>		
Oct 25-29	General annuities, mortgages, Perpetuities, (section 4.1-4.2-4.3)	
Nov 1-5	<b>FALL READING WEEK</b>	
Nov 8-12	Varying annuities (section 4.3), Amortization (section 5.1)	
<b>In-class Quiz #3 – Tues/Wed, November 9/10 at start of class</b>		
Nov 15-19	Outstanding balance, Refinancing, Sum of digits (section 5.2, 5.3, 5.4)	
Nov 22-26	Sinking Funds (sect 5.5/5.6/5.7) Bonds–Purchase price (sect 6.1/6.2)	
Nov 29-Dec 3	Premium and Discount, Callable Bonds, Bonds bought between dates (section 6.3, 6.4, 6.5)	
<b>In-class Quiz #4 – Tues/Wed, November 30/December 1 at start of class</b>		
Dec 6-8	Rate of return on a bond, other types of bonds (section 6.6, 6.7)	
<b>Midterm Exam – To be scheduled during the December Exam period (3 hours)</b>		
<b>Week – 2022</b>		
Jan 3-7	Net present value, internal rate of return, dollar weighted and time weighted rates of return (section 7.1, 7.2, 7.3, 7.4)	
Jan 10-14	Capitalized Costs, Depreciation (section 7.5, 7.6);	
Jan 17-21	Fixed income investments, yield curve, forward interest rates (sections 8.1, 8.2),	
<b>In-class Quiz #5 – Tues/Wed, January 18/19 at start of class</b>		
Jan 24-28	Types of risks (section 8.3); Duration, convexity (sections 8.4 to 8.7)	
Jan 31-Feb 4	Probability, life tables probabilities (section 9.1 to 9.5)	
Feb 7-11	Expectation of life, select mortality (section 9.6, 9.7)	
<b>In-class Quiz #6 – Tues/Wed, February 8/9 at start of class</b>		
Feb 14-18	Life annuities, pure endowments (section 10.1, 10.2, 10.3)	
Feb 21-25	<b>WINTER READING WEEK</b>	
Feb 28-Mar 4	Whole life, temporary and deferred life annuities, (section 10.4-10.6)	
<b>Test 2 – Friday, March 4 – 6 pm to 8 pm (2 hours) – Chapters/Sections TBA</b>		
Mar 7-11	Varying annuities, life annuities payable more than once a year, whole life insurance (section 10.7, 10.8, 11.1)	
Mar 14-18	Whole life insurance (section 11.2, 11.3), Net Annual Premiums (11.4)	
<b>In-class Quiz #7 – Tues/Wed, March 15/16 at start of class</b>		
Mar 21-25	Term, endowment, deferred, varying insurance (sect 11.5 to 11.8)	
Mar 28-Apr 1	Expenses; Types of life insurance expenses (section 12.1, 12.2)/ Review	
<b>In-class Quiz #8 – Tues/Wed, March 29/30 at start of class</b>		
<b>Final Exam – To be scheduled in final exam period</b>		

## 12. Student Absences

### **Academic Consideration for Student Absences**

Students who experience an extenuating circumstance (illness, injury or other extenuating circumstance) sufficiently significant to temporarily render them unable to meet academic requirements may submit a request for academic consideration through the following routes:

- (i) Submitting a Self-Reported Absence (SRA) form provided that the conditions for submission are met. To be eligible for a Self-Reported Absence:
  - an absence must be no more than 48 hours
  - the assessments must be worth no more than 30% of the student's final grade
  - no more than two SRAs may be submitted during the Fall/Winter term
- (ii) For medical absences, submitting a Student Medical Certificate (SMC) signed by a licensed medical or mental health practitioner to the Academic Counselling office of their Faculty of Registration.
- (iii) Submitting appropriate documentation for non-medical absences to the Academic Counselling office in their Faculty of Registration.

Note that in all cases, students are required to contact their instructors within 24 hours of the end of the period covered.

Students should also note that individual instructors are not permitted to receive documentation directly from a student, whether in support of an application for consideration on medical grounds, or for other reasons. **All documentation required for absences that are not covered by the Self-Reported Absence Policy must be submitted to the Academic Counselling office of a student's Home Faculty.**

For the policy on Academic Consideration for Student Absences – Undergraduate Students in First Entry Programs, see:

[https://www.uwo.ca/univsec/pdf/academic\\_policies/appeals/accommodation\\_illness.pdf](https://www.uwo.ca/univsec/pdf/academic_policies/appeals/accommodation_illness.pdf)

and for the Student Medical Certificate (SMC), see:

[http://www.uwo.ca/univsec/pdf/academic\\_policies/appeals/medicalform.pdf](http://www.uwo.ca/univsec/pdf/academic_policies/appeals/medicalform.pdf)

### **Religious Accommodation**

When a course requirement conflicts with a religious holiday that requires an absence from the University or prohibits certain activities, students should request accommodation for their absence in writing at least two weeks prior to the holiday to the course instructor and/or the Academic Counselling office of their Faculty of Registration. Please consult University's list of recognized religious holidays (updated annually) at

<https://multiculturalcalendar.com/ecal/index.php?s=c-univwo>

### **Absences from Examinations**

If you miss the Final Exam, please contact the Academic Counselling office of your Faculty of Registration as soon as you are able to do so. They will assess your eligibility to write the Special Examination (the name given by the University to a makeup Final Exam).

You may also be eligible to write the Special Exam if you are in a “Multiple Exam Situation” (e.g., more than 2 exams in 23-hour period, more than 3 exams in a 47-hour period).

### **13. Accommodation and Accessibility**

#### **Accommodation Policies**

Students with disabilities work with Accessible Education (formerly SSD), which provides recommendations for accommodation based on medical documentation or psychological and cognitive testing. The policy on Academic Accommodation for Students with Disabilities can be found at:

[https://www.uwo.ca/univsec/pdf/academic\\_policies/appeals/Academic\\_Accommodation\\_disabilities.pdf](https://www.uwo.ca/univsec/pdf/academic_policies/appeals/Academic_Accommodation_disabilities.pdf)

### **14. Academic Policies**

The website for Registrarial Services is <http://www.registrar.uwo.ca>

In accordance with policy,

[https://www.uwo.ca/univsec/pdf/policies\\_procedures/section1/mapp113.pdf](https://www.uwo.ca/univsec/pdf/policies_procedures/section1/mapp113.pdf)

the centrally administered e-mail account provided to students will be considered the individual's official university e-mail address. It is the responsibility of the account holder to ensure that e-mail received from the University at his/her official university address is attended to in a timely manner.

**Scholastic offences** are taken seriously and students are directed to read the appropriate policy, specifically, the definition of what constitutes a Scholastic Offence, at the following Web site:

[http://www.uwo.ca/univsec/pdf/academic\\_policies/appeals/scholastic\\_discipline\\_undergrad.pdf](http://www.uwo.ca/univsec/pdf/academic_policies/appeals/scholastic_discipline_undergrad.pdf)

Computer-marked multiple-choice tests and exams may be subject to submission for similarity review by software that will check for unusual coincidences in answer patterns that may indicate cheating.

### **15. Support Services**

Please visit the Social Science Academic Counselling webpage for information on adding/dropping courses, academic considerations for absences, appeals, exam conflicts, and many other academic related matters: <https://counselling.ssc.uwo.ca>

Please contact the course instructor if you require lecture or printed material in an alternate format or if any other arrangements can make this course more accessible to you. You may also wish to contact Accessible Education at (519) 661-2147 if you have any questions regarding accommodations.

Learning-skills counsellors at the Student Development Centre (<http://www.sdc.uwo.ca>) are ready to help you improve your learning skills. They offer presentations on strategies for improving time management, multiple-choice exam preparation/writing, textbook reading, and more. Individual support is offered throughout the Fall/Winter terms in the drop-in Learning Help Centre, and year-round through individual counselling.

Students who are in emotional/mental distress should refer to Mental Health@Western (<http://www.health.uwo.ca/mentalhealth>) for a complete list of options about how to obtain help.

Additional student-run support services are offered by the USC, <http://westernusc.ca/>